

### **Amendments to the Claims**

This listing of claims will replace all prior versions, and listings, of claims in the application:

#### **Listing of Claims:**

1. (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each transducer head for recording on and playback of information from a corresponding storage media medium in multiple zones, the method comprising the steps of:
  - (a) (1) for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and
    - (2) for said multiple data storage devices, based on said performance measurements, jointly jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and
      - (b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on a capability of that head.
  2. (Currently Amended) The method of claim 1, wherein in step (a)(1) measuring a performance of each head further includes the step steps of measuring a record/playback performance of that head at one or more read/write frequencies.

3. (Currently Amended) The method of claim 1, wherein in step (a)(1) measuring a performance of each head further includes the step steps of measuring a record/playback performance of that head at multiple storage media medium locations.

4. (Currently Amended) The method of claim 1, wherein in step (a)(1) measuring a performance of each head further includes the step steps of measuring a record/playback performance of that head according to a performance metric at different frequencies.

5. (Currently Amended) The method of claim 4, wherein said performance metric includes at least one of on-track symbol error rate-on track, off-track symbol error rate-off track, on-track mean square squared error-on track, and off-track mean square squared error-off track.

6. (Currently Amended) The method of claim 1, wherein step (a) is performed in a storage format design process and step (b) is performed in a test process.

7. (Currently Amended) The method of claim 6, wherein the storage format design process is part of a data storage device design phase and the test process is part of a data storage device manufacturing phase.

8. (Currently Amended) The method of claim 1, wherein step (a)(1) further includes the step steps-of calibrating each of said multiple data storage devices for each of said frequencies.

9. (Currently Amended) The method of claim 1, wherein step (a)(2) further includes the step steps-of jointly selecting said frequencies and allocating said heads to said frequencies, to satisfy a specified constraint.

10. (Currently Amended) The method of claim 9, wherein:  
step (a)(1) further includes the steps of, for each of said sample number of said data storage devices:

selecting a performance metric for the heads in that data storage device for each zone; and  
measuring a performance of each head at different frequencies per zone based on said metric; and  
step (a)(2) further includes the step steps-of, for the multiple data storage devices:

based on said performance measurements, for each zone allocating an integral number of said heads to each of said frequencies for that zone to satisfy the specified constraint.

11. (Currently Amended) The method of claim 10, wherein in step (a)(2) allocating said heads to said frequencies per zone further includes the step of, steps of:

for each zone, based on the performance of the heads in a plurality of zones, allocating an integral number of said heads to each of said frequencies for that zone to satisfy said constraint for said multiple data storage devices.

5           12. (Currently Amended) The method of claim 10, wherein step (a)(2) further includes the steps of:

                  based on said performance measurements, generating record/playback frequency capability distributions of the heads in the sample number of said data storage devices, disk drives, at each zone for a target performance metric, and  
5                   based on said distributions, allocating an integral number of said heads to each of said frequencies for that zone to satisfy said constraint for said multiple data storage devices.

13. (Original) The method of claim 9, wherein said constraint comprises providing a required data storage capacity for each of said multiple data storage devices.

14. (Previously Presented) The method of claim 9, wherein said constraint comprises providing a required data storage device yield for said multiple data storage devices.

15. (Currently Amended) The method of claim 9, wherein said constraint comprises maximizing a the data storage device yield for the multiple data storage

devices while providing a specified data storage device capacity for each of the multiple data storage devices.

16. (Currently Amended) The method of claim 9, wherein said constraint comprises maximizing a the data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield for the multiple data storage devices.

17. (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each transducer head for recording on and playback of information from a corresponding storage media medium in multiple zones, the method comprising the steps of:

(a) (1) for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and based on said performance measurements, generating performance distributions of the heads in said sample number of said data storage devices, at each zone for a target performance metric, and

(2) for said multiple data storage devices, based on said performance distributions, jointly jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone;

15 and

(b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on a capability of that head.

18. (Currently Amended) The method of claim 17, wherein generating said distributions further includes the steps of:

estimating a record/playback frequency capability of each head based on said performance measurements; measurements, and

generating record/playback frequency capability distributions of the heads at each zone for said a-target performance metric based on said estimated record/playback frequency capabilities of the heads.

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19. (Currently Amended) The method of claim 17, wherein the step steps of generating said distributions is performed in a post-processing phase.

20. (Currently Amended) The method of claim 17, wherein generating said distributions includes the step of steps of generating record/playback frequency capability distributions of the heads based on said performance measurements at said a target performance metric for the heads in said sample number of said data storage devices.

21. (Currently Amended) The method of claim 17, wherein in step (a)(2) selecting said group of frequencies further includes the step steps of selecting said group of frequencies to satisfy a specified constraint.

22. (Currently Amended) The method of claim 17, wherein said performance metric includes at least one of on-track symbol error rate-on track, off-track symbol error rate-off track, on-track mean square squared error-on track, and off-track mean square squared error-off track.

23. (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each transducer head for recording on and playback of information from a corresponding storage media medium in multiple zones, the method comprising the steps of:

- (a) (1) for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and
- (2) for said multiple data storage devices, based on said performance measurements, jointly selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and for each zone allocating an integral number of said heads to each of said frequencies for that zone to satisfy a constraint; and
- (b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on a capability of that head and said allocation of the heads.

24. (Currently Amended) The method of claim 23, wherein step (b) further includes the steps of, for each of said multiple data storage devices:

(i) obtaining a record/playback performance of each head at a performance metric per zone at one of said read/write frequencies;

5 (ii) for each zone, ranking the heads from best to worst according to the performance metric; and

(iii) assigning said allocated number of heads, according to the ranking, to one of said read/write frequencies.

25. (Currently Amended) The method of claim 24, further comprising the step steps-of:

repeating steps (i)-(iii) for the remaining heads at the other read/write frequencies.

26. (Original) The method of claim 24, wherein steps (i)-(iii) are repeated for each of said frequencies, starting from the highest frequency to the lowest frequency.

27. (Currently Amended) The method of claim 24, wherein ~~wherein~~-step (ii) further includes the step steps-of selecting said performance metric for the heads in that data storage device for each zone.

28. (Currently Amended) The method of claim 23, wherein for each head in said multiple data storage devices, the same said-number of said zones are on different storage media in each data storage device.

29. (Currently Amended) The method of claim 23, wherein for each head in said multiple data storage devices, the same said-number of said zones are on the same storage media in each data storage device.

30. (Currently Amended) The method of claim 23, wherein in step (a)(2) said constraint specified criteria comprises providing a specified data storage capacity for each of the multiple data storage devices while maximizing a data storage device yield for the multiple data storage devices.

31. (Currently Amended) The method of claim 23, wherein in step (a)(2) said constraint specified criteria comprises maximizing a the data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield for the multiple data storage devices.

32. (Currently Amended) The method of claim 23, wherein step (b) further includes the step steps of calibrating each data storage device for each frequency.

33. (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each ~~transducer~~-head for recording on and playback of information from a corresponding storage media medium in multiple zones, the method comprising the steps of:

(a) (1) for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and

(2) for said multiple data storage devices, based on said performance measurements, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on a capability of that head;

wherein in each of said multiple data storage devices:

said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

such that each storage media includes the same number of concentric zones as other storage media in that data storage device, and such that the boundaries of radially similarly situated zones on all the storage media in that data storage device are at the same radial locations.

34. (Original) The method of claim 33, wherein radially similarly situated zones on all the storage media include the same number of concentric tracks.

35. (Currently Amended) The method of claim 33, wherein at least a number of radially similarly situated zones on all the storage media include a different number of concentric tracks.

36. (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each ~~transducer~~-head for recording on and playback of information from a corresponding storage media medium in multiple zones, the method comprising the steps of:

(a) (1) for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and

(2) for said multiple data storage devices, based on said performance measurements, jointly ~~jointly~~: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on a capability of that head;

wherein in each of said multiple data storage devices:

    said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

such that each storage media includes a sequence of concentric zones, and  
~~such that~~ the boundaries of at least a number of sequentially similarly situated zones on  
different storage media in that data storage device are at different radial locations.

37. (Original) The method of claim 36, wherein sequentially similarly situated  
zones on all the storage media include the same number of concentric tracks.

38. (Currently Amended) The method of claim 36, wherein at least a number  
of sequentially similarly situated zones on all the storage media include a different  
number of concentric tracks.

39. (Currently Amended) A data storage device comprising a plurality of pairs  
of storage media surfaces and transducer heads, each ~~transducer~~ head for recording on  
and playback of information from a corresponding storage media surface medium in  
multiple zones, and a controller that controls the heads for reading and writing data on the  
5 storage media surfaces, the controller being programmed to write data in a storage format  
defined by the steps including:

(a) (1) for a sample number of multiple data storage devices, measuring a  
performance of each head in the sample number of said data storage devices at one or  
more read/write frequencies per zone, and

10 (2) for said data storage device, based on said performance  
measurements, jointly: selecting a group of read/write frequencies, two or more

read/write frequencies for each zone, and allocating one or more of the heads in said that data storage device to each frequency in said group of frequencies per zone; and

(b) in said data storage device, assigning one of said frequencies to each head per zone, based on a capability of that head, thereby defining said storage format.

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40. (Currently Amended) The data storage device of claim 39, wherein in step (a)(1) measuring a performance of each head further includes the step steps of measuring a record/playback performance of that head according to a performance metric at different frequencies.

41. (Currently Amended) The data storage device of claim 39, wherein step (a) is performed in a data storage device design phase and step (b) is performed in a data storage device manufacturing phase.

42. (Currently Amended) The data storage device of claim 39, wherein step (a)(1) further includes the step steps of calibrating each of said multiple data storage devices for each of said frequencies.

43. (Currently Amended) The data storage device of claim 39, wherein step (a)(2) further includes the step steps of jointly selecting said frequencies and allocating said heads to said frequencies, to satisfy a specified constraint.

44. (Currently Amended) The data storage device of claim 43, wherein:

step (a)(1) further includes the steps of, for each of said sample number of  
said data storage devices:

selecting a performance metric for the heads in that data storage

5 device for each zone; and

measuring a performance of each head at different frequencies per  
zone based on said metric; and

step (a)(2) further includes the step steps of, for the multiple data storage  
devices:

10 based on said performance measurements, for each zone allocating  
an integral number of said heads to each of said frequencies for that zone to satisfy the  
specified constraint.

45. (Currently Amended) The data storage device of claim 44, wherein in step

(a)(2) allocating said heads to said frequencies per zone further includes the step of, steps  
~~ef~~—for each zone, based on the performance of the heads in a plurality of zones,  
allocating an integral number of said heads to each of said frequencies for that zone to  
5 satisfy said constraint for said multiple data storage devices.

46. (Currently Amended) The data storage device of claim 44, wherein step  
(a)(2) further includes the steps of:

based on said performance measurements, generating record/playback frequency capability distributions of the heads in the sample number of said data storage devices, disk drives, at each zone for a target performance metric; metric; and

5 based on said distributions, allocating an integral number of said heads to each of said frequencies for that zone to satisfy said constraint for said multiple data storage devices.

47. (Original) The data storage device of claim 43, 44, wherein said constraint comprises providing a required data storage capacity for each of said multiple data storage devices.

48. (Previously Presented) The data storage device of claim 43, wherein said constraint comprises providing a required data storage device yield for said multiple data storage devices.

49. (Currently Amended) The data storage device of claim 43, wherein said constraint comprises maximizing a the data storage device yield for the multiple data storage devices while providing a specified data storage device capacity for of the multiple data storage devices.

50. (Currently Amended) The data storage device of claim 43, wherein said constraint comprises maximizing a the data storage capacity for each of the multiple data

storage devices while providing a specified data storage device yield for the multiple data storage devices.

51. (Currently Amended) A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each transducer head for recording on and playback of information from a corresponding storage media surface medium in multiple zones, and a controller that controls the heads for reading and writing data on the storage media surfaces, the controller being programmed to write data in a storage format defined by the steps including:

(a) (1) for a sample number of multiple data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and based on said performance measurements, generating performance distributions of the heads in said sample number of said data storage devices, at each zone for a target performance metric, and

(2) for the data storage device, based on said performance distributions, jointly selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b) in the data storage device, devices, assigning one of said frequencies to each head per zone, based on a capability of that head.

52. (Currently Amended) The data storage device of claim 51, wherein generating said distributions further includes the steps of:

estimating a record/playback frequency capability of each head based on  
said performance measurements; ~~measurements~~, and

5 generating record/playback frequency capability distributions of the heads  
at each zone for said a-target performance metric based on said estimated record/playback  
frequency capabilities of the heads.

53. (Currently Amended) The data storage device of claim 51 wherein the step  
~~steps~~-of generating said distributions is performed in a post-processing phase.

54. (Currently Amended) The data storage device of claim 51, wherein  
generating said distributions includes the step of steps of-generating record/playback  
frequency capability distributions of the heads based on said performance measurements  
at said a-target performance metric for the heads in said sample number of said data  
storage devices.

55. (Currently Amended) The data storage device of claim 51, wherein in step  
(a)(2) selecting said group of frequencies further includes the step steps-of selecting said  
group of frequencies to satisfy a specified constraint.

56. (Currently Amended) A data storage device comprising a plurality of pairs  
of storage media surfaces and transducer heads, each ~~transducer~~-head for recording on  
and playback of information from a corresponding storage media surface medium-in  
multiple zones, and a controller that controls the heads for reading and writing data on the

storage media surfaces, the controller being programmed to write data in a storage format defined by the steps including:

(a) (1) for a sample number of multiple data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and

(2) for said data storage device, based on said performance measurements, jointly selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and for each zone allocating an integral number of said heads to each of said frequencies for that zone to satisfy a constraint; and

(b) in said data storage device, assigning one of said frequencies to each head per zone, based on a capability of that head and said allocation of the heads.

57. (Currently Amended) The data storage device of claim 56, wherein step (b) further includes the steps of, for the data storage device:

- (i) obtaining a record/playback performance of each head at a performance metric per zone at one of said read/write frequencies;
- (ii) for each zone, ranking the heads from best to worst according to the performance metric; and
- (iii) assigning said allocated number of heads, according to the ranking, to one of said read/write frequencies.

58. (Currently Amended) The data storage device of claim 57, wherein step  
(b) further comprises the step steps of:

repeating steps (i)-(iii) for the remaining heads at the other read/write frequencies.

59. (Currently Amended) The data storage device of claim 57, wherein step (b) further includes the step steps of selecting said performance metric for the heads in the that data storage device for each zone.

60. (Currently Amended) The data storage device of claim 56, wherein in step (a)(2) said constraint specified criteria comprises providing a specified data storage capacity for the multiple data storage devices while maximizing a data storage device yield for the multiple data storage devices.

61. (Currently Amended) The data storage device of claim 56, wherein in step (a)(2) said constraint specified criteria comprises maximizing a the data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield for the multiple data storage devices.

62-64. (Cancelled)

65. (Currently Amended) A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each transducer head for recording on and playback of information from a corresponding storage media surface medium in multiple zones, and a controller that controls the heads for reading and writing data on the

5       storage media surfaces, the controller being programmed to write data in said multiple zones, wherein:

          said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

10      such that each storage media includes a sequence of concentric zones, and such that the boundaries of at least a number of sequentially similarly situated zones on different storage media in the that-data storage device are at different radial locations, wherein sequentially similarly situated zones on all the storage media include the same number of concentric tracks.

66-67. (Cancelled)